

# Adaptive Interfaces for Web Museum Applications: the Virtual Marble Museum

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## Abstract

If we consider most museums applications accessible through the Web, we can notice a lack of support able to adapt to the different information needs that different users may have regarding a certain topic. Adaptive support, by which an application provides different information taking into account the users' interactions, can give useful assistance. In particular, we focus our attention on how to obtain adaptable and adaptive web museum interfaces using the web site for the Marble Museum (Carrara, Italy), which we have designed and developed, as a source of examples for our discussion of possible solutions.

## **INTRODUCTION**

The growth of the Web has changed the way in which people access information and spend their free time. Curators of museums have realised the need for supporting the requests of these new users as well as traditional visitors.

Users interact with museum application interfaces for many reasons. There are various types of users, who want to perform various tasks, in various contexts, that can access the same web site. Thus, it is important to have user interfaces able to adapt to these different user requirements to facilitate the accomplishment of the desired goals. Most current interfaces to museum information do not take into account this variety of types of users, thus providing interfaces that some users find confusing to achieve their goals. In this paper we discuss the various possible levels of support that can be given to different users during navigation of museum information.

Adaptation is traditionally classified into adaptivity or adaptability. In the former case the application is able to automatically modify its behaviour depending on the user interactions (often this is done with the support of some user model). Whereas in the latter case the application changes its behaviour according to a small set of explicit predefined options that users have to select.

Museum web sites are applications where adaptation can be particularly suitable because they address a wide set of types of users. One of the main goals of these applications is to improve learning of groups of related information and concepts and they usually have a large mass of information with consequent risk of disorientation for end users. However, most current user interfaces of museum applications are not adaptive at all and they provide the same support for every type of user, without taking into account the sequences of interactions that they perform.

## **THE DESIGN CRITERIA**

Systems supporting adaptation tailor information to the user and may guide the user in the information space to present the most relevant material, taking into account a model of the user's goals, interests and preferences. Such an adaptation can occur at three levels in hypermedia applications:

- *Presentation*, where it is possible to differentiate the type of media, the layout, the attributes of the perceivable elements (such as font type and size) depending on the type of access;
- *Information*, where the information content can be changed, sometime drastically, even if related to the same topic, depending on the type of user and the use foreseen;
- *Navigation*, where different links are provided, in some cases in different locations and with different appearance, determining different modalities of navigation in the information available.

Adaptive user interfaces allow designers to obtain flexible environments, especially when they are supported by agents oriented to provide interactive support, because they are able to change depending on how the user interacts with the application. However, a completely automatic adaptive support can be rather confusing for end users that may find a system changing dynamically its behaviour without understanding the reasons for such changes. Thus, when designing adaptive support it is important to allow users to clearly understand:

- When the adaptive support can be activated;
- How the adaptive support provides information;
- Which criteria drive the generation of information provided by the adaptive support.

In order to enrich and facilitate the navigation in the available information, adaptivity of a museum environment should be easily understood. Thus, users must have full control on when activating adaptive navigation, and they should be supported, during their visit, by using a number of techniques. More precisely, we want that the information delivered can be adaptive according several logical dimensions [PM00]:

- *Introduction information*, whenever a new topic or aspect is accessed the system should provide introduction information on that topic;
- *Summary information*, the system should be able to provide some summary information concerning the items that have been accessed in the current session;
- *Comparison information*, where the purpose is to compare the current information with that previously accessed for some common aspect;
- *Difference information*, in this case the purpose is to describe an attribute that was not present in the previous information;
- *Curiosity information*, indicating related information that can raise the interest of the user.

Thus, we aim to obtain a richer set of logical dimensions to discuss and present information than that considered in previous works such as [M97] that mainly focus on comparisons (illustrative, clarification and direct).

## **THE APPLICATION**

The Marble Museum is located in Carrara (Italy). The town is famous for the many white marble quarries located in the nearby Apuan Alps. Such a material has been used since the Romans period for many works of art (Pietà by Michelangelo, just to mention one of the most famous). White marble has been used not only for artistic purposes but also in other fields, such as architecture and artisanship. However, the museum contains works made by any kind of marble, not only white Carrara marble. The hypermedia provides information concerning the works of arts placed in the museum (in particular there is an interesting Modern Sculpture section), on tools that have been used to quarry and process marble. The web site also contains descriptions of pieces of works located in the historical centre of the town that can be considered as a natural extension of the museum as it is particularly rich of artistic works made by marble, such as marble icons, sculptures, monuments and so on.

In our project we first designed and implemented an adaptable system (<http://giove.cnuce.cnr.it/Museo.html>) and, later on, we have started a new design aiming at introducing an agent-based support in a virtual museum we developed beforehand.

The first application that we have developed is an adaptable system [PM99] that was designed following a model-based approach. We first identified the tasks that users interacting with this type of application intend to perform and the logical description of these activities was taken into account during the design of the interactive application. The result was a user interface particularly suitable to support such tasks.

We developed three user models associated with this application, one for each main type of user identified (expert, tourist, student of art). Tourists are characterised by the need for basic general information, expressed and presented clearly. They like to access information by spatial representations (for example a museum or a city map) because this gives implicitly information to them concerning how to organise a physical visit. Students have a better knowledge of the application domain so they want to access a wider range of topics, receiving more detailed information. Finally, experts want to have full access to all the information available. They need minimal support to formulate their requests and should be allowed to formulate such requests in a flexible way. When there is a classification of possible users it is always possible to find specific cases that do not fit in any of them but we have found this classification suitable for most visitors to this museum.

At the beginning of the session, the user has to select one user model. According to this selection, the application provides different support, mainly for three types of aspects:

- *Initial access to the museum information*, for example, the expert can specify directly very specific requests whereas tourists mainly access by spatial representations of the museum and the town;
- *Presentation of the information related to the works of art*, the decision of the amount and type of information to provide and the modalities of presentation takes into account the basic knowledge of the type of users and the different tasks that they are likely to wish to perform;

- *Navigation in the hypermedia*, which is more structured and pre-ordered for tourists whereas more navigational freedom is given to expert users.

Then, we have designed a new system that provides additional adaptive support. To give full control to users on the adaptive support, when the choice of the user model appears we give the user the possibility of selecting how the agent-based support should be activated. Users can choose among three options: activation of the virtual guide, keeping disabled the virtual guide, possibility to activate the virtual guide during the navigation. If the last option is selected, when a work of art is presented there is also an additional button that allows the user to activate the virtual guide at any time.

When the agent is activated, beside the presentation of a work of art, there is a part of the main window dedicated to the comments of the virtual guide (see Figure 1). The additional information provided through the virtual guide aims to make the users' visit more interesting and pleasant.

Another goal is to provide additional dynamic information that help users link the standard information associated with each work of art, in a manner similar to when a visitor is accompanied by a real museum guide. Thus, at any time we have both standard information that is provided in any case associated with the work of art selected, and the agent-based support that provides additional information taking into account the user model and the interactions performed.



Figure 1: An example of user interface of the web application including the virtual guide.

The virtual guide provides the types of information introduced before with a content tailored for the museum application considered:

- *Summary information.* After having visited a number of works of art, it can be useful to provide the user with a summary of the most important aspects that have been considered. For example, if the user visits several works of the same historical period this can be interpreted as a strong interest for works belonging to that period. Then, a summary of the most important aspects of that historical period can be provided.
- *Comparison Information.* They allow users to relate works of art or compare them, for example comparing dimensions, chronology.
- *Difference information.* In this case, the purpose is to highlight the difference between a work those previously accessed. This information is useful for the user to better learn and remember the descriptions of the works of art.
- *Additional curiosity information.* They are additional peculiar information that can increase the involvement of the visitor highlighting the features of the work that can raise the user's interest.

## **CONCLUSIONS**

We have described an approach that aims to improve the usability of web sites for museums by introducing user interfaces able to adapt to different users. More precisely, we have described a new system supporting an integration of an agent with adaptive behaviour in a previously adaptable application. This allows us to obtain a flexible environment with an agent able to adapt its behaviour and the information provided to different types of users depending on their interests and goals.

The system has been implemented with servlets which are java program running on the server side and generating html files that are presented on the user side. The advantage of this solution is that the user browser has to process simple information thus requiring little time to be interpreted and visualised.

The agent-based support has been designed to be under full control of the user that can determine when to enable or disable it. Such support follows a set of clearly understandable criteria and the information provided makes the users' visits more pleasant, increases their involvement, and better matches their interests.

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